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SURFACE WATER TECHNICAL REPORT

Support Document for the

Draft Environmental Impact Statement

Anaconda Nevada Moly Project

Lead Agency

U.S. Department of the Interior
Bureau of Land Management
Nevada State Office
P. O. Box 12000
Reno, Nevada 89520

Prepared by

ENVIRONMENTAL RESEARCH & TECHNOLOGY, INC.
FORT COLLINS, COLORADO

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PREFACE

The Anaconda Copper Company of Denver, Colorado, plans to develop an open pit molybdenum mine and flotation mill plant on privately owned land and public land on which the company has located mining claims under the general mining laws, approximately 18 miles north of the town of Tonopah in Nye County, Nevada. In order to supply power to the Anaconda project, Sierra Pacific Power Company of Reno, Nevada, has filed with the U.S. Bureau of Land Management (BLM) an application for a right-of-way to construct and operate a 230kv electric transmission line which would cross 86 miles of public land in the Big Smoky Valley in Nye and Lander Counties. Sierra Pacific's right-of-way application initiated BLM's environmental analysis process and the decision was made to prepare an Environmental Impact Statement (EIS) on the proposed transmission line and the Anaconda mine/mill complex. The EIS is being prepared on a contract basis by Environmental Research & Technology, Inc. (ERT), of Fort Collins, Colorado.

This report was prepared by ERT as a preliminary step in the EIS preparation process. The report provides detailed information on the surface water of potentially affected areas and discusses the impacts of the proposed project on these resources.

The surface water report is one of a series of ten technical reports prepared by ERT as background and documentary material for the EIS. Each report presents the results of field and literature studies in the affected environments and results of impact analyses. The technical reports are intended as background documents and information in them is, in many cases, considerably more detailed than will be included in the EIS.

Chapter 1, "Alternatives Including the Proposed Action", can be found in the Draft Environmental Impact Statement which is on file with copies of the technical reports at the following locations: BLM offices in Washington, D.C.; Reno; Battle Mountain; Carson City; Elko; Ely; Las Vegas; and Winnemucca, Nevada. The following public libraries will also receive copies: the Churchill Public Library, Fallon; Clark County Library, Las Vegas; the Elko County Library, Elko; the Esmeralda County Library, Goldfield; the Eureka County Library, Eureka; the Lander County

Library, Battle Mountain; the Mineral County Library, Hawthorne; the Nevada State Library, Carson City; the Nye County Library, Tonopah; the Washoe County Library, Reno; and the White Pine County Library, Ely. Draft EISs will also be sent to the University of Nevada Libraries in Reno and Las Vegas.

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CHAPTER 1

ALTERNATIVES INCLUDING THE PROPOSED ACTION

(Refer to the Draft Environmental Impact Statement)

CHAPTER 2

EXISTING ENVIRONMENT

INTRODUCTION

This section describes existing baseline conditions for surface water resources associated with the proposed mine/mill complex and transmission line. Evaluation of these conditions is based on field surveys conducted during 1978, review of literature, and agency contacts and data.

REGIONAL OVERVIEW

The Big Smoky Valley is a hydrologic sub-basin centrally located in the Great Basin, a large and diverse hydrologic basin characterized by elevated valleys generally over 5,000 feet in altitude. The Great Basin is a geographic region composed of combinations of hydrologic sub-basins separated by prominent divides and exhibiting meteorological and climatological homogeneity. Topography of the basin is one of north-south trending mountains alternating with broad valleys. Mountains are composed of varied lithologies including sandstones, siltstones, shales, and younger volcanic rock. Valleys are characteristically wide and flat. Annual precipitation averages 6 inches or less per year in the valleys and 20 inches or more in the high mountains, with the majority falling between October and May. Intense, localized, and short-lived thunderstorms are characteristic of the summer months.

The central portion of the Great Basin contains many valleys that are closed hydrologic sub-basins, including the Big Smoky Valley. These closed sub-basins contain playa lakes which typify areas with low precipitation and high evaporation rates.

Runoff volumes in the semiarid environment are closely related to stream drainage area and channel geometry and composition. Maximum flow is generally achieved at the mountain front. As the flow departs the mountains onto the alluvial valley, it typically loses velocity and volume. Because of the rapid infiltration rates in the alluvium, little stream flow reaches the valley floors and playa lakes except after periods of heavy thunderstorm precipitation or periods of high snowmelt runoff.

MINE/MILL COMPLEX

The factors that influence the surface water resources of the mine/mill complex are a combination of climatic and geomorphic conditions. Precipitation data indicate an average annual rainfall of 6 inches on the western edge of the property near the valley floor, and an annual average of 8 inches on the mountains to the east. The geomorphic features of the complex are recognized as mountains, alluvial apron and valley floor. The mine/mill complex is located in the contact zone between consolidated rock and alluvium. The consolidated rock within this area is primarily volcanic and is extremely fractured and weathered. Pediments overlay much of the consolidated rock in the mountains. The alluvial fans coming off the mountains are composed of well graded sands and smaller rock and are highly permeable.

Surface water resources of the mine/mill complex are characterized by their relative scarcity. With the exception of Peavine Creek, a small intermittent stream west of the complex, and Liberty Spring, a small spring south of the complex, localized surface water discharge potentially occurs only for short periods during high-intensity thunderstorms or as runoff from melting snow. These are erratic sources of streamflow which do not constitute a significant proportion of the surface water resources of the entire Big Smoky Valley.

Primary drainages at the complex are shown in Map 2-1. Table 2-1 delineates the associated watershed characteristics. The drainages are very small with areas typically less than 4 square miles. The mountain channels are very steep with slopes approaching a 20% flow gradient. The impermeable nature of the higher mountain lithologies combined with steep flow gradients contribute to the greatest flow velocities and volumes occurring at the mountain front. Little evidence of stream flow activity beyond the mountain canyons exists at the complex. Runoff volumes in the channels exiting the property have been small, probably due to the lack of precipitation, small drainage area, reduced flow gradient, and the permeability of pediments and alluvium.

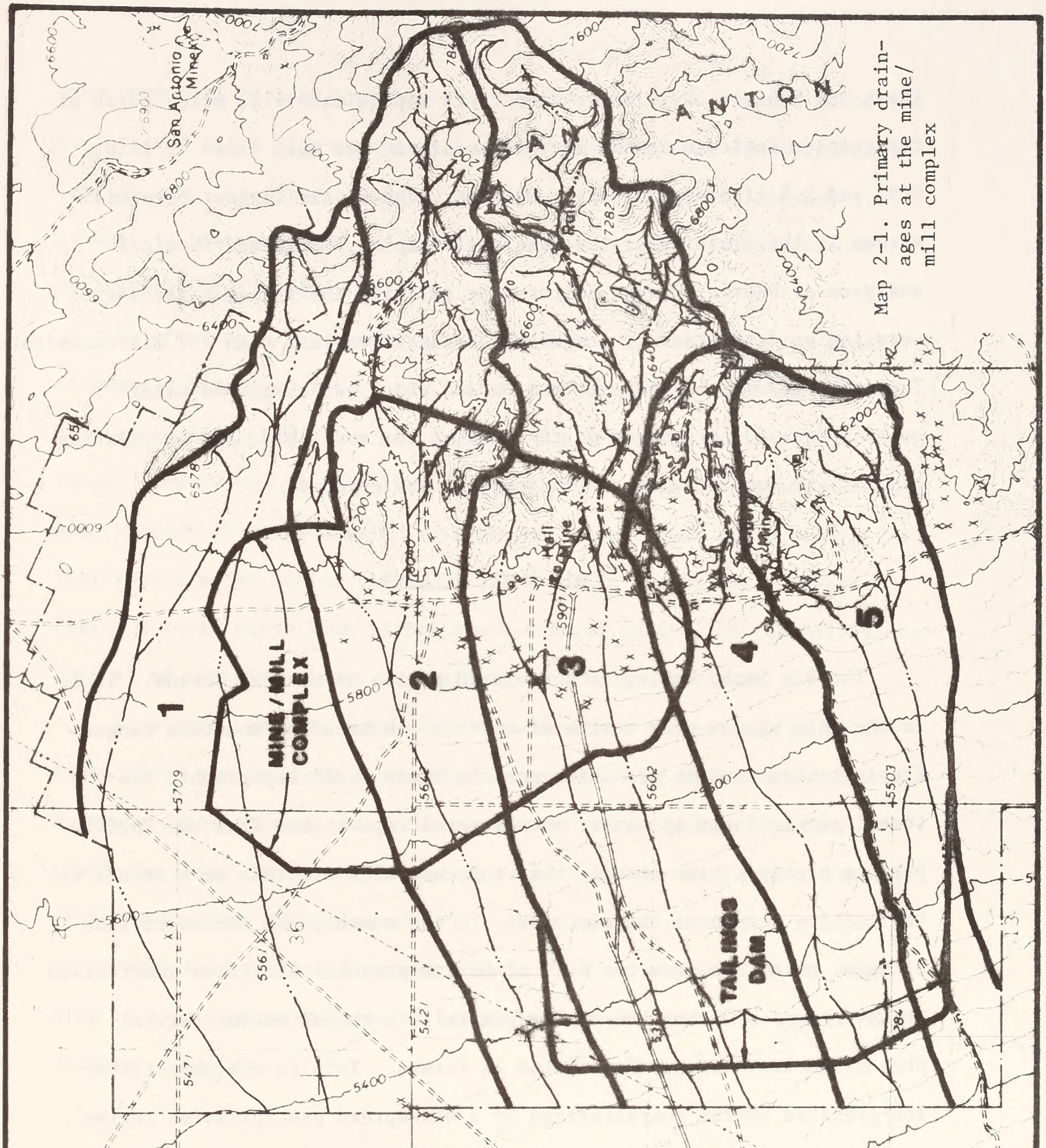
The single most significant factor in terms of surface water resources at the mine/mill complex is the "flash flood" event that occurs near the mountain front as a result of localized severe thunderstorms. These events are erratic and unpredictable.

No surface gaging data are available in the immediate vicinity of the complex. The nearest USGS gaging station is located approximately 40 miles to the north on South Twin River. Flow data collected in 1968

TABLE 2-1

DESCRIPTION OF DRAINAGES AT MINE/MILL COMPLEX, NYE COUNTY, NEVADA

Drainage	Area (mi^2)	Elevation Difference (ft)	Channel Length (mi)	Mountain Channel Slope (%)	Alluvial Fan Channel Slope (%)	Average Channel Slope (%)
1	3.5	1901	4.0	18	5	9
2	2.6	2514	4.8	14	5	10
3	3.5	2554	5.1	13	5	9
4	1.6	1655	3.4	17	5	9
5	1.5	1695	3.4	17	5	9



Map 2-1. Primary drainages at the mine/mill complex

(Rush and Schroer 1971) on Peavine Creek approximately 20 miles north of the complex indicate annual maximum, minimum, and mean flows of 11.0, 0.9, and 2.8 cfs respectively. Peavine Creek is the largest perennial stream in the vicinity of the mine/mill complex. Selected chemical analyses of Peavine Creek indicate the salinity and sodium hazards are very low as determined by a specific conductance less than 250 micromhos/cm. The water is suitable for irrigation and stock watering. No water quality data for drainages at the complex are available, and no existing uses of the surface water at the complex are evident.

BIG SMOKY VALLEY

The Big Smoky Valley is a semiarid region of central Nevada. It is in the rain shadow of a series of north-south trending mountain ranges. Precipitation regimes are influenced by these local topographic features, particularly in winter when frontal type storms from the Pacific produce precipitation amounts that increase with altitude as a result of the lifting action of the air mass. In the summer, the northward flow of warm, moist air from the Gulf of Mexico produces localized short-lived thunderstorms. During the spring and fall, a unique meteorological phenomenon known as the Nevada Low is formed. This is a high-altitude low-pressure system characterized by a widespread precipitation regime not significantly influenced by topography. Precipitation in Big Smoky Valley ranges from 6 inches or less on the valley floor to 20 inches or more in the higher mountains, such as the Toiyabe and Toquima ranges.

Most of the streamflow in Big Smoky Valley is produced from snowmelt in the Toiyabe and Toquima ranges. Irrigation water is diverted from perennial streams near the foot of the mountains. Almost no stream or diverted ditch flow reaches the valley floor because of rapid infiltration into the alluvial apron. Many small intermittent springs are evident in the mountains and on the alluvial aprons. Primary use of spring flow is for stock watering.

Selected data collected in 1968 (Rush and Schroer 1971) on primary streams in Big Smoky Valley are listed in Table 2-2. Locations of the streamflow measuring sites are shown on Map 2-2. The maximum mean annual flow of the streams listed is 4.8 cfs on Kingston Creek. Perennial streams at the mountain front become intermittent and ephemeral as they approach the valley floor, losing velocity and volume. Alkali Flats, a large playa lake in the south-central portion of the valley, is typical of the playa lakes in the Basin and Range Province.

Localized, intense summer thunderstorms are the primary cause of flash flood events which move immense quantities of sediment downstream. However, deposition of the material usually occurs before the flows reach the lower levels of the valley except for the very finest portion of the suspended sediment load (silt and clay-size particles). Lower unit volumes of surface flow are associated with snowmelt runoff resulting in lower concentrations of suspended sediment and less significant sediment transport.

TABLE 2-2

SELECTED STREAM DATA, BIG SMOKY VALLEY, NEVADA[a]

Stream	Site Number	Streamflow Measuring Site Location	Altitude in Feet		Area of Basin in mi^2	Estimated Discharge in 1968 (cfs)		
			Canyon Mouth	Maximum in Basin		Maximum	Minimum	Mean
Willow Creek	01	T19N, R44E	6,600	8,510	8.8	---	---	---
Simpson Park Canyon	02	T19N, R45E	6,100	8,614	---	---	---	---
Birch Creek	03	T18N, R44E	6,150	10,793	17.5	2.4	0.9	1.4
Tar Creek	04	T17N, R44E	6,800	10,793	2.2	0.9	0	0.2
Rock Creek	05	T17N, R44E	6,800	10,996	1.8	---	---	---
Crooked Canyon	06	T17N, R44E	6,500	11,071	1.7	---	---	---
Globe Canyon	07	T16N, R44E	6,800	11,071	2.0	---	---	---
Santa Fe Creek	08	T16N, R44E	6,550	11,474	2.3	---	---	---
Kingston Creek	09	T16N, R43E	6,300	11,474	23.4	7.4	2.8	4.8
Bowman Creek	10	T15N, R43E	6,450	10,975	7.0	3.8	0.7	0.9
Decker Creek	11	T15N, R43E	6,250	10,453	2.4	3.1	0.3	0.8
Alice Gendron Creek	12	T14N, R43E	6,250	10,960	2.1	---	---	---
McLeod Creek	13	T14N, R43E	6,150	10,327	2.9	3.7	0.1	0.6
Wildcat Creek	14	T13N, R42E	6,300	10,600	1.2	---	---	---
Clay Creek	15	T13N, R42E	6,300	10,600	1.9	---	---	---
Summit Creek	16	T13N, R42E	6,600	10,400	2.9	1.0	0.2	0.6
Wisconsin Creek	17	T13N, R42E	6,500	10,600	4.0	---	---	---
Ophir Creek	18	T13N, R42E	6,400	10,600	3.9	4.2	0.3	1.1
Last Chance Creek	19	T12N, R42E	6,600	10,800	3.8	---	---	---
North Twin River	20	T12N, R42E	6,400	10,800	15.2	13.0	0.8	3.1
South Twin River	21	T12N, R42#	6,400	11,788	20.0	15.0	1.1	4.0
Belcher Canyon	22	T11N, R42E	6,300	11,353	5.1	7.0	0.1	1.0
Cove Canyon	23	T11N, R42E	6,400	11,353	2.6	---	---	---
Broad Creek	24	T11N, R42E	6,400	11,353	6.1	4.6	0.2	1.0
Jett Creek	25	T10N, R42E	6,300	11,165	7.3	6.8	0.1	1.6
Moores Creek	26	T12N, R44E	6,800	11,400	8.5	0.6	0.2	0.5
Barker Creek	27	T11N, R44E	7,000	11,800	7.5	3.1	0.5	0.9
Jefferson Creek	28	T10N, R44E	6,600	11,949	20.6	4.6	0	1.0
Shoshone Creek	29	T10N, R44E	6,800	10,916	6.1	1.3	0	0.2

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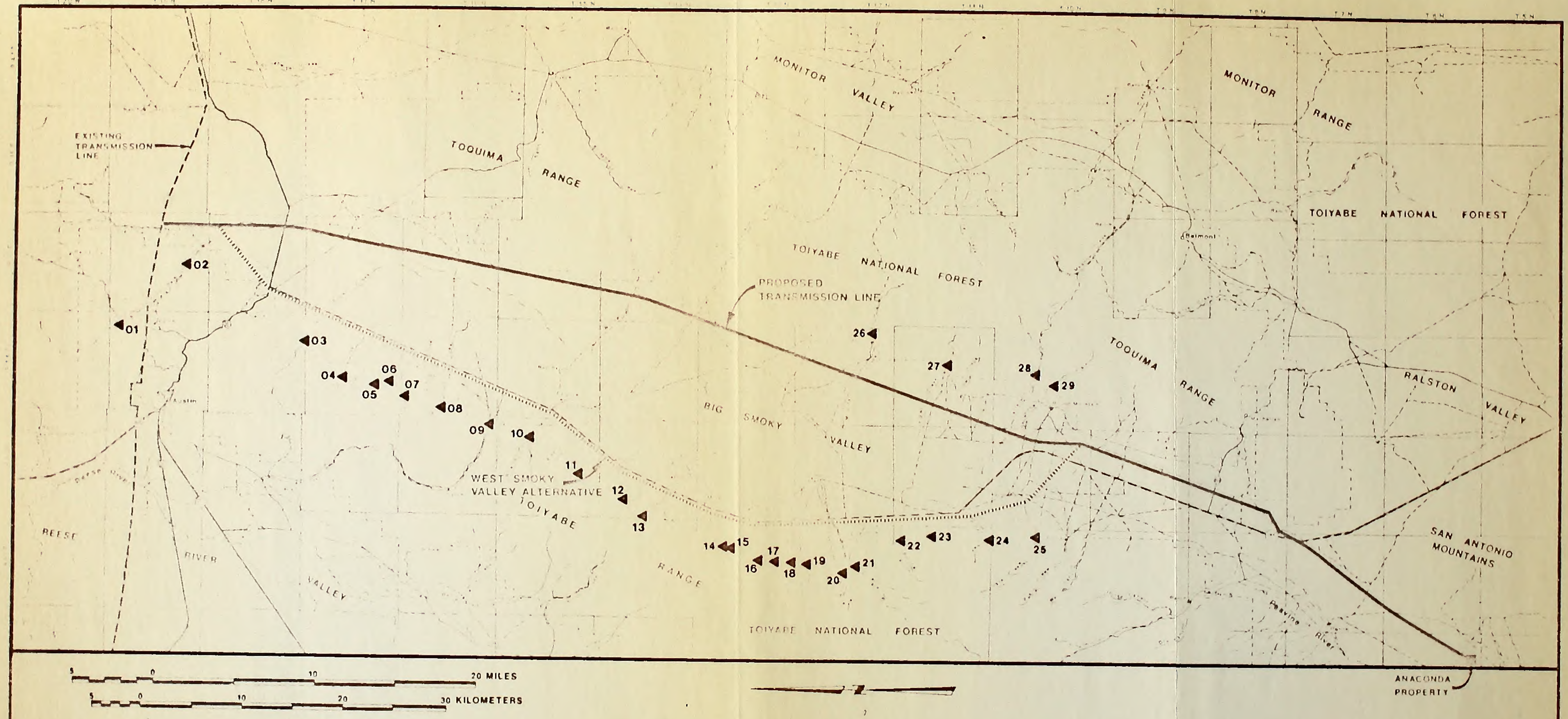
[a] Flow measurements made in 1968 (Rush and Schroer 1971).



Map 2-2. Selected stream measurement locations, Big Smoky Valley, Nevada

CHAPTER 3

ENVIRONMENTAL CONSEQUENCES

ASSUMPTIONS AND ANALYSIS GUIDELINES

Impact analysis for surface water resources was based on the following mitigation measures:

- All construction access would be reviewed and approved prior to construction with existing roads and trails used wherever possible. All travel would be limited to specified overland routes unless existing roads and trails are available for use. Natural grass and low brush would be routinely removed. Only brush blade or back-blade techniques would be used in such areas to remove surface rock.

- Where access trails cross live streams or dry stream beds, culverts or other structures, as determined by BLM, would be installed. Upon termination of use, these items may be required to be removed by BLM. Additionally, no dry or intermittent drainage channels would be blocked with debris, and no soil along roads and trails would be pushed into stream beds.

- Measures necessary to assume unrestricted passage and movement of fish and wildlife would be taken. No artificial structure or stream channel alteration that would cause a blockage to the movement of fish would be allowed.

- The applicant would comply with any special requirements made by BLM for a stream system. All operations would be conducted in such a manner as would avoid permanent blockage of any drainage system; changing the character of causing the pollution or siltation of rivers, streams, reservoirs, ponds, water holes or springs; and damaging fish and wildlife resources and habitat.

- Mobile ground equipment would not be operated in streams, ponds, springs, water holes, or reservoirs unless such operation is approved in writing by BLM.

- Facilities would be located so as to provide a 300-foot minimum buffer strip of undisturbed land on each side of a stream or river, unless otherwise approved by BLM.

EFFECTS OF IMPLEMENTING THE PROPOSED ACTION

Mine/Mill Complex

Impacts

Construction of a mine/mill complex could potentially cause the following effects:

- Construction of surface facilities could decrease permeable surfaces in the area and result in increased surface runoff.
- Removal and mixing of overburden along with exposure of overburden highly susceptible to weathering could lead to soluble material being carried into streams by runoff, consequently affecting water quality.
- Increased runoff and surface disturbance could potentially cause increases in sediment yield to area streams.

However, after analyzing the potential effects it was concluded that construction of the mine/mill complex would not significantly impact water resources.

The conclusion of no significant impact on surface water resources at the mine/mill site was based on the fact that surface water is scarce at the site (Peavine Creek, an intermittent creek is the only stream at the site) and that surface water discharge occurs only for short periods of time during high intensity thunderstorms.

The tailings pond has been sited in such a location that runoff from the mine/mill complex would be captured in the tailings pond. (Tables 3-1, 3-2 and Figures 3-1, 3-2 provide information utilized in developing runoff estimates.) Therefore, expected changes in runoff patterns would result in runoff entering the tailings pond and would not lead to effects on water quality or water quantity in streams or other surface waters in the project area.

TABLE 3-1

PROJECTED FLOW VOLUME ENTERING TAILINGS DAM

Watershed a/	Area (mi^2)	100-Year Precipitation (in/hr) b/	100-Year Direct Runoff (in) c/	Probable Maximum Precipitation (PMP) (in/hr) b/	PMP Direct Runoff (in.) c/	100-yr+ PMP Runoff Volume (ac-ft)	100-yr+ ½ PMP Runoff Volume (ac-ft)
3	3.5	0.95	0.30	6.00	4.86	964	510
4	1.6	0.95	0.30	6.00	4.86	441	233
5	1.5	0.95	0.30	6.00	4.86	413	218
					TOTAL	1,818	961

---

a/ Refer to Figure 2-1 for locations of primary drainages through tailings dam.

b/ Weather data provided for 100-year precipitation is for Tonopah, Nevada. The probable maximum precipitation taken from Figure 3-1 (U.S.D.I., Bureau of Reclamation 1977).

c/ Direct runoff calculated using standard SCS methods with curve number (CN) equal to 90. (U.S.D.A., Soil Conservation Service 1972.)

TABLE 3-2

RAINFALL RECURRENCE INTERVALS AND RAINFALL INTENSITIES

Recurrence Interval [a]	Rainfall Intensity (in./hr)
2 - Year	0.37
10 - Year	0.60
25 - Year	0.72
50 - Year	0.84
100 - Year	0.95
Probable Maximum	6.00

[a] The 2-year through 100-year rainfall intensities taken from weather data for Tonopah, Nevada. The probable maximum rainfall taken from Figure 3-1 (U.S.D.I., Bureau of Reclamation 1977.)

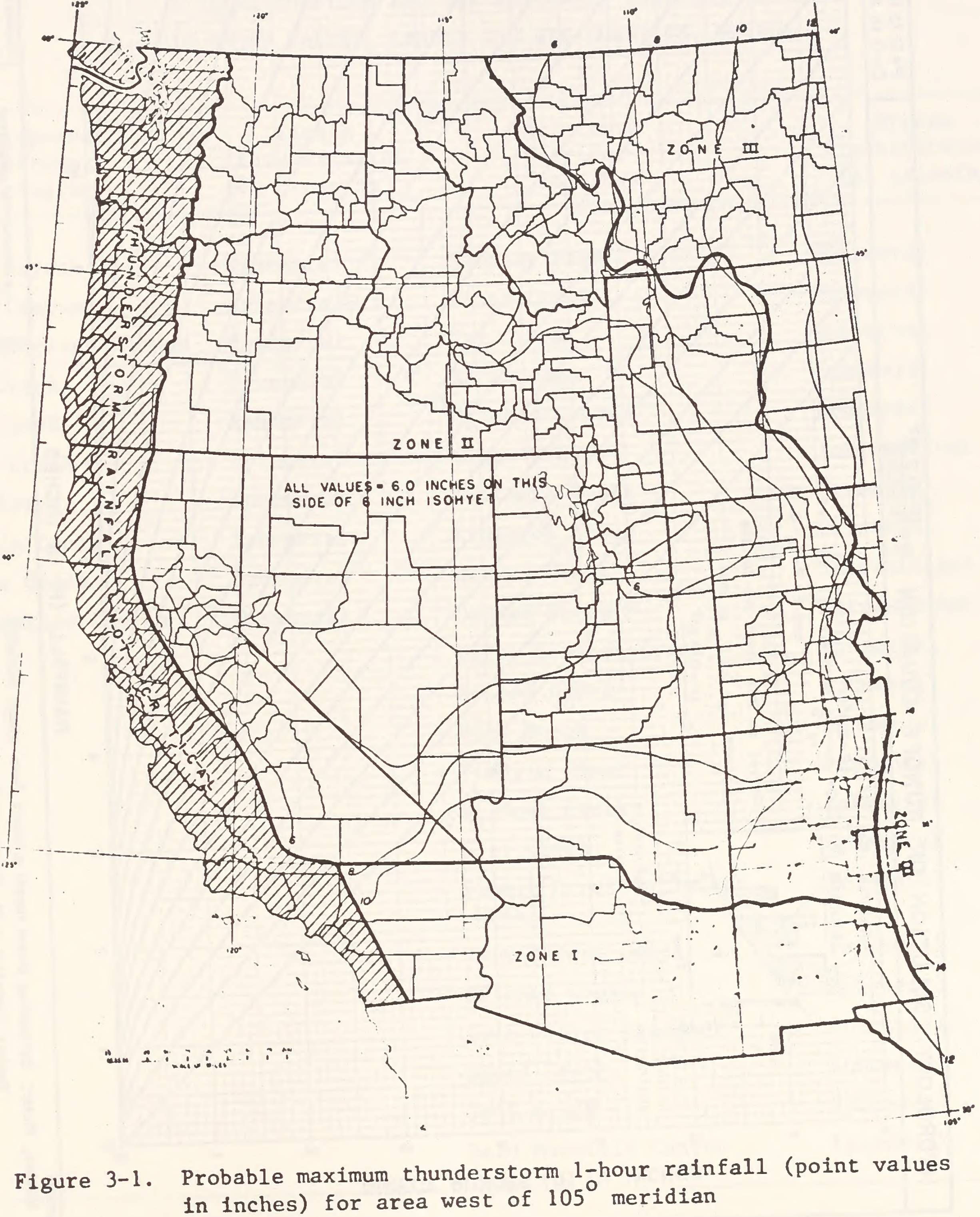

ZONE III
ZONE II
ZONE I
ALL VALUES = 6.0 INCHES ON THIS SIDE OF 6 INCH ISOHYET
THUNDERSTORM RAINFALL NOT CRITICAL
125°
120°
115°
110°
105°
45°
40°
35°
30°
6
8
10
12
14
12

Figure 3-1. Probable maximum thunderstorm 1-hour rainfall (point values in inches) for area west of 105° meridian

Source: USDI, Bureau of Reclamation 1977

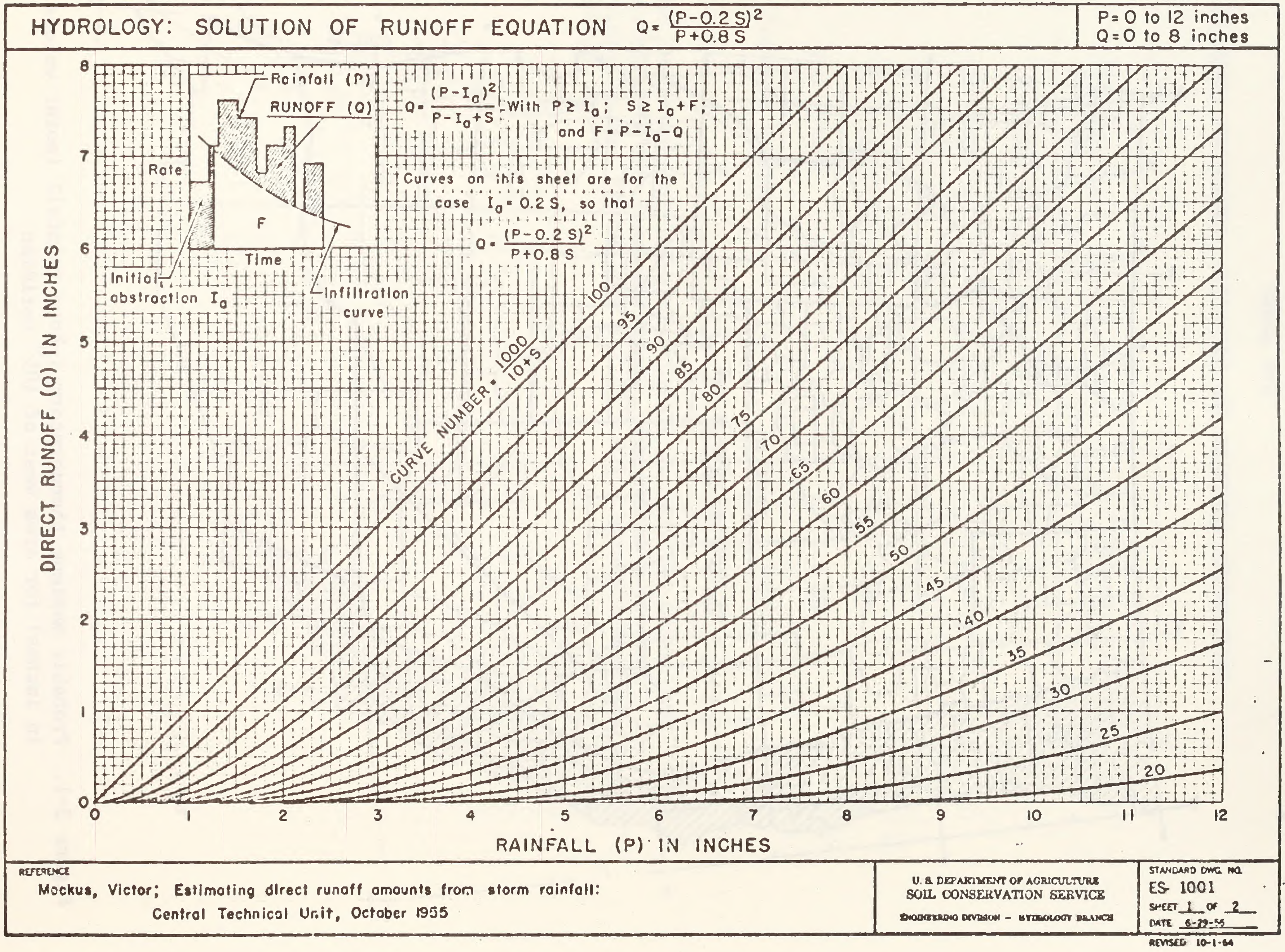


Figure 3-2. Determination of direct runoff from storm rainfall

TABLE 3-3

STREAMS CROSSED BY THE PROPOSED 230kV TRANSMISSION LINE CORRIDOR AND THE ALTERNATE CORRIDOR IN BIG SMOKY VALLEY, LANDER AND NYE COUNTIES, NEVADA

Proposed Corridor Crossings	Stream Classification (at crossing)	Alternate Corridor Crossings	Stream Classification (at crossing)
Willow Canyon	Ephemeral	Simpson Park Canyon	Ephemeral
Wildcat Canyon	Ephemeral	Birch Creek	Perennial
Northcumberland Canyon	Ephemeral	Tar Creek	Ephemeral
Moores Creek	Perennial	Rock Creek	Ephemeral
Barker Creek	Ephemeral	Crooked Canyon	Ephemeral
Shipley Creek	Ephemeral	Globe Canyon	Intermittent
Willow Creek	Ephemeral	Santa Fe Creek	Perennial
Jefferson Creek	Ephemeral	Kingston Creek	Perennial
Shoshone Creek	Ephemeral	Bowman Creek	Intermittent
Bald Mountain Canyon	Ephemeral	Decker Creek	Intermittent
		Alice Gendron Creek	Ephemeral
		McLeod Creek	Ephemeral
		Park Creek	Ephemeral
		Timblin Canal	Perennial
		Wildcat Creek	Ephemeral
		Clay Creek	Ephemeral
		Summit Creek Collector Canal	Perennial
		Twin Rivers Canal	Perennial
		Belcher Canyon	Ephemeral
		Love Canyon Aqueduct	Perennial
		Broad Creek	Ephemeral
		Jett Creek	Ephemeral
		Bald Mountain Canyon	Ephemeral

Transmission Line Corridor

Construction of the proposed transmission line would constitute ten stream crossings along the primary corridor which runs along the east side of the Big Smoky Valley. The alternate route would parallel the west side of Big Smoky Valley and cross twenty-four streams. Most of the streams crossed along both corridors are ephemeral and are expected to be dry during the period of construction in the fall and winter. Low perennial stream flows of less than 3 cfs are also common during this period. A list of stream crossings and respective classifications is included in Table 3-3. Table 2-2 lists streams in the valley and the minimum recorded flows.

Primary Corridor

Impacts. The proposed primary corridor would run along the eastern edge of the Big Smoky Valley. Along this route ten stream crossings would be encountered. Of these streams only one perennial stream, Moore's Creek, would be crossed by construction vehicles. Crossings would occur during low-flow periods (winter), would be kept to a minimum, and would be adequately regulated by the mitigation measures. The remainder of the streams are ephemeral and would probably not contain flow during the construction period. Therefore, there would be no significant impact on surface water resources associated with construction of the transmission line.

EFFECTS OF IMPLEMENTING ALTERNATIVE 1, WEST SMOKY VALLEY ALTERNATIVE CORRIDOR

The proposed alternate route runs along the west side of the Big Smoky Valley. This route would entail 16 ephemeral stream crossings and 7 perennial stream crossings. No flow is anticipated in the ephemeral streams and only very low flow in the perennial streams. The perennial stream crossings are generally only a short distance upstream from the start of ephemeral flow resulting from evaporation and infiltration losses. Although crossing of a perennial stream might result in a temporary increase in suspended sediment, impact to the water resources would be insignificant. In addition, the mitigation measures would reduce any of the temporary impacts.

EFFECTS OF IMPLEMENTING ALTERNATIVES 2, 3, AND 4

Effects of Implementing Alternatives 2, 3, and 4 would be the same as Proposed Action and Alternative 1.

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Because of insignificant impact on water resources, this is no significant relationship between short-term use and long-term productivity.

CHAPTER 4

LIST OF PREPARERS

INTRODUCTION

The following individuals had primary responsibility for preparing the technical report. Their education, project responsibilities, qualifications, and experience are summarized below.

ENVIRONMENTAL RESEARCH AND TECHNOLOGY, INC.

Richard Spotts, Hydrologist
B.S. in Civil Engineering, Colorado State University

Anaconda Copper Nevada Moly Project: Responsible for data compilation and for coordination of the technical report for the water resources discipline.

Experience includes collection, compilation and analysis of hydrology data, including flood hazards, in preparation for writing environmental reports and mining plans; monitoring system design and field installation of both surface and groundwater networks.

William S. Krupke, Hydrologist
Continuing Education through National School of Conservation (Extension)

Anaconda Copper Nevada Moly Project: Added support in the writing of the water resources technical report.

Experience includes field design of monitoring networks and installation of both groundwater wells and surface water gaging stations.

Randall J. Snellenberger, Geologist/Geohydrologist
Candidate for B.A. in Geology, Indiana State University

Anaconda Copper Nevada Moly Project: Added support in writing of the technical report for water resources.

Experience includes field installations of groundwater and surface water monitoring stations; collection and analysis of hydrologic data in preparation for writing environmental reports.

CHAPTER 5

CONSULTATION AND COORDINATION

Consultation and coordination for the water resources has included meetings and/or telephone conversations with various federal and state agencies. The following specific activity occurred as part of this program.

Date	Activity
6/5/78	Meeting with Bureau of Land Management, Tonopah, Nevada

Federal Government

U.S. Department of the Interior
Bureau of Land Management
Battle Mountain District Office

State Government

Nevada Department of Conservation and Natural Resources
Division of Water Resources

CHAPTER 6

APPENDIX A

METHODOLOGY

Mine/Mill Complex

Watershed characteristics were determined from standard U.S.G.S. topographic maps. Drainage areas were calculated through the utilization of a polar planimeter. Units used were square miles determined by:

Area in square miles = (Planimeter units) X

(Area per planimeter unit)

Channel length was calculated by an opisometer which is an instrument having a dial connected by gears to a small roller wheel. Each channel length was calculated three times and an average taken to reduce error (Schulz 1974).

Runoff volume was determined by standard Soil Conservation Service methods as referenced in the National Engineering Handbook, Section 4, Hydrology. Runoff volume was calculated by determining the direct runoff for the 100-year precipitation event and adding to it ½ the direct runoff for the probable maximum precipitation event. Calculations were determined as follows:

$$S = \frac{1000}{CN} - 10$$

then

$$Q = \frac{(P - .2S)^2}{P + .8S}$$

where: CN = curve number
Q = direct runoff (in)
P = precipitation (in)

A CN of 90 was used in order to assimilate the poor hydrologic conditions associated with relatively impermeable mountain soils and sparse vegetative covering.

Transmission Line

Stream classifications were taken from standard U.S.G.S. topographic maps. The following definitions (Cargo, 1974) were applied for classification purposes:

perennial stream - a stream flowing continuously because the precipitation is great enough and the groundwater table stays high enough to provide a continuous supply of water

intermittent stream - a stream flowing during wet seasons, when the groundwater table is high enough to intersect the stream channel and sustain the stream flow between rains. In dry seasons flow ceases due to low groundwater table and lack of runoff

ephemeral stream - a stream that flows only during and shortly after precipitation periods

CHAPTER 7

GLOSSARY

ALLUVIUM Deposits which are the result of deposition by streams. Generally composed of sand and/or gravel.

EPHEMERAL STREAM A stream that carries water only after rains or periods of snowmelt.

FLOW GRADIENT The slope of the channel bed.

GEOMORPHIC CONDITIONS Related to the topographic features of the land surface.

INTERMITTENT STREAM A stream that carries water most of the time but occasionally ceases to flow because evaporation and seepage into the bed and banks exceeds the available streamflow.

PEDIMENTS The contact plain between mountain and basin areas composed of eroded bedrock. Typical of arid-semiarid regions.

PERENNIAL STREAM A stream that contains water at all times except during extreme droughts.

RECURRENCE INTERVAL The average number of years between events (rainfall or flood) of equal or greater magnitude.

SALINITY AND SODIUM HAZARDS The potential detrimental effect on crops of total dissolved solids and dissolved sodium in water.

TOTAL DISSOLVED SOLIDS The total content of mineral matter in solution in water, indicated in milligrams per liter.

CHAPTER 8

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